● PRINTER RUSH ●
(PTO ASSISTANCE)

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[RUSH] **MESSAGE:** Specification. Pages No. 27 and 28 please provide serial Nos. and Dates are missing.

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[XRUSH] **RESPONSE:** Done

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MHz. Conversely, once computer 608 ends his transmission, MPS 604 and 605 become aware that additional bandwidth has become available and can take measures to increase data rates accordingly. In this example, MPS 604 may choose to restore the data rates associated with computers 619-621.

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In the interim during which a computer transmits data packets faster than its MPS can insert those data packets onto the ring, data packets "back up" within in a FIFO buffer within the MPS. In the above example, the data rates associated with computers 619-620 were decreased. Suppose that the

10   effect of these data rate reductions is that computers 619-620 generate packets faster than those packets are now allowed to be put on ring 607 (in order to guarantee the QoS of upstream computer 608). The extra data packets are stored in their respective buffers 622-624. Subsequently, when bandwidth becomes available, MPS 604 can increase the data rates at which

15   packets associated with computers 619-621 are inserted onto ring 607. The back up of data packets within buffers 622-624 is eliminated by the increased rates of transmission onto ring 607. In some rare cases, buffers may overflow which results in packet loss. It should be noted that, technically, all data packets are first buffered in the first-in-first-out (FIFO) buffers before being

20   put on the ring.

Additional descriptions of the architecture of the MPTR, MPS, and RMS can be found in U.S. Patent applications "GUARANTEED QUALITY OF SERVICE IN AN ASYNCHRONOUS METRO PACKET TRANSPORT

25   RING", filed on 6/30/2000 serial number 09608747 assigned to the assignee of the present invention which is incorporated herein in its entirety, and "PER-FLOW CONTROL FOR AN ASYNCHRONOUS METRO PACKET TRANSPORT

RING", filed on 5/13/2004, serial number 10846297 assigned to the assignee of the present invention which is incorporated herein in its entirety.

Figure 7 shows a diagram of a virtual flow control process 700 in
5 accordance with one embodiment of the present invention. Process 700 shows the operation of one buffer (e.g., within one MPS) in conjunction with the operation of the respective virtual queue which keeps track of the flow rate of the local input flow through the buffer.

10 Process 700 begins in step 701, where the flow rate of each flow in the MPTR is continually monitored using the respective virtual queue. As described above, a virtual queue is implemented for all flows to track the ring bandwidth utilization of the flows. As described above, each MPS is configured to aggressively allocate unused bandwith to all flows. Usually, the spare
15 bandwidth is allocated proportionally with respect to each flow's assigned QoS. As described above, however, higher priority QoS flows are maintained at the expense of lower priority flows when insertion traffic bandwidth is temporarily constrained.

20 The use of virtual queues allow the MPS to ensure QoS integrity without enforcing traffic compliance by dropping packets. In other words, bandwidth ulitilization is controlled by throttling the local input flows (e.g., the flow source) as opposed to dropping transit flow packets. The virtual queues are used to keep track of the backlog of the flows. The virtual queues are drained at the
25 rate specified by the QoS scheduler and the backlog is measured in the units of time it takes to empty a virtual queue. The specifics of the operation of the virtual queues are discussed in greater detail below.

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